

UNITED STATES PATENT APPLICATION

of

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for

ROUTING NOTIFICATIONS TO MOBILE DEVICES

BACKGROUND OF THE INVENTION

1. The Field of the Invention

The present invention relates to notifications for wireless devices. More particularly, the present invention relates to systems, methods, and computer program products for routing notifications to wireless devices over high capacity channels and more specifically for re-routing notifications to wireless devices over high capacity channels when they are available to the wireless device.

2. Background and Related Art

Wireless devices, such as cellular telephones, pagers, and personal digital assistants (PDAs) are quite common and their use and importance are increasing daily. For example, cellular telephones were originally intended for voice communication. Today, cellular telephones are being used to receive and store electronic messages, calendar data, and contact lists. Some wireless devices even allow a user to access the Internet in limited ways. The ever increasing capabilities of wireless devices are placing a strict demand on the systems that deliver information to wireless devices. Unfortunately, current delivery systems are often unable to satisfactorily meet the delivery requirements of newer wireless devices.

Much of the information currently stored by wireless devices, such as electronic messages and appointments, has a tendency to become stale, old, or no longer needed. As a result, it is often necessary to update the stored data. An update is necessary, for example, when a new electronic message arrives or when new appointments are added to the calendar data.

1 Historically, devices are updated by connecting with a server and performing a
2 ‘batch’ synchronization to update both the device and the server. Batch synchronization
3 updates all changes since the last synchronization and is usually performed over a dial-up
4 connection or Local Area Network connections that have attributes of higher throughput,
5 reliability and low cost. As an alternative, each individual change can be sent to the device
6 (or from the device to the server) when the change occurs. This approach has the
7 advantage of being automatic. In addition, the data stored on the device is substantially
8 current. This approach, however, requires that these updates or ‘notifications’ be delivered
9 to the device asynchronously, wherever the device may be located.

10 Currently, delivering data to and from wireless devices uses short messaging
11 system (SMS) or related technologies. SMS was originally designed for devices such as
12 pagers, where the electronic traffic is limited to short textual messages. SMS has a
13 relatively low capacity to transmit data, can be costly, and can have high latency. SMS is
14 often used to send a short message to another wireless device, receive a notification from a
15 network that a voicemail has been stored, and the like. While SMS is ill suited to support
16 systems and methods that generate substantially higher data traffic, it does have the
17 desirable characteristics of having fairly global coverage already in place and is usually
18 available for small information transfers at a nominal cost.

SUMMARY OF THE INVENTION

2 These and other problems are overcome by the present invention, which is directed
3 towards routing notifications over higher capacity channels when the higher capacity
4 channels are available. When data at a server changes, a notification is sent to a wireless
5 device. The notification can either notify the wireless device that an object at the server
6 has changed or include the changed object in the notification. For example, when a new
7 email arrives at a server, the notification can either inform the wireless device that a new
8 email is at the server or the notification can include the new email. As previously
9 described, the notification usually occurs over a low capacity wireless channel that is often
10 slow, costly and inherently latent.

11 The present invention effectively causes notifications to be routed over higher
12 capacity and less costly channels when the higher capacity channels are available to the
13 wireless devices instead of using the more costly lower capacity channel. For example,
14 many wireless devices have the ability to dock or connect with a desktop computer or other
15 network device when the user is in their office or home. Many desktop computers have
16 access to a Local Area Network (LAN) or the Internet, and when a wireless device is
17 docked or in communication with the desktop computer or its LAN, the wireless device
18 advises the notification server that a higher capacity channel is available through the
19 desktop computer and its network connection. When the notification server is aware that
20 the wireless device has access to a higher capacity channel, notifications are routed to the
21 wireless device over the higher capacity channel. As long as the wireless device has access
22 to the higher capacity channel, notifications can be sent quickly, inexpensively, and more
23 efficiently.

1 Access to the higher capacity channel, however, can be terminated abruptly.
2 Removing the wireless device from its docking station, for example, may immediately cut
3 off access to the higher capacity channel. When the wireless device no longer has access
4 to the higher capacity channel, the notification server resumes sending notifications over
5 the lower capacity SMS wireless channel as before.

6 Detecting that the higher capacity channel is no longer available can be performed
7 in several different ways. While docked, for example, the wireless device can be required
8 to send an acknowledgement to the notification server for each notification that the
9 wireless device receives. If an acknowledgement is not received by the notification server
10 within a pre-determined time period, the notification server resumes sending notifications
11 over the lower capacity channel. Alternatively, the characteristics of the higher capacity
12 channel can be used to determine if the higher capacity channel is still available. For
13 instance, if Transmission Control Protocol/Internet Protocol (TCP/IP) is used, then the
14 severance of the higher capacity channel is detected when the socket is dropped. In
15 another example, the wireless device can send a notification to the server that the
16 connection has been severed. In each case, notifications are again sent over the low
17 capacity channel until a higher capacity channel becomes available.

18 Additional features and advantages of the invention will be set forth in the
19 description which follows, and in part will be obvious from the description, or may be
20 learned by the practice of the invention. The features and advantages of the invention may
21 be realized and obtained by means of the instruments and combinations particularly
22 pointed out in the appended claims. These and other features of the present invention will
23 become more fully apparent from the following description and appended claims, or may
24 be learned by the practice of the invention as set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the manner in which the above-recited and other advantages and features of the invention can be obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 illustrates an exemplary system that provides a suitable operating environment for the present invention;

Figure 2 is a block diagram illustrating a server that communicates with a wireless device over a high capacity channel when the high capacity channel is available and over a low capacity channel otherwise; and

Figure 3 is a more detailed block diagram of the communication channels over which a server may communicate with a wireless device.

DETAILED DESCRIPTION OF THE INVENTION

2 Communication with a wireless device can be a costly and relatively slow process.
3 The present invention relates to systems and methods that allow communication with a
4 wireless device to occur over channels that have higher capacity than the default low
5 capacity channel when the higher capacity channels are available. When a higher capacity
6 channel is available, a notification server reroutes notifications to a wireless device over
7 the higher capacity channel. The notification server resumes employing the low capacity
8 channel when the higher capacity channel is no longer available. This provides significant
9 advantages. First, the higher capacity channel has a much lower cost in comparison to the
10 low capacity channels currently employed by wireless devices. The higher capacity
11 channel also provides more bandwidth and is more reliable. Because the higher capacity
12 channel is not always available to the wireless device, the lower capacity channel is
13 frequently used to ensure continuous update capability to the wireless device.

14 As used herein “notification” refers to communication with a wireless device and
15 can refer to both incoming and outgoing communications. Notifications typically occur
16 when an object is created or modified. Thus, when an object on a server changes, the
17 wireless device receives a notification. The notification can simply inform the wireless
18 device that an object has been created, modified, or otherwise changed or the notification
19 can include the created or modified object. A notification is usually associated with a
20 single data object, but as used herein, notification may be associated with more than one
21 data object.

As used herein “high capacity channels” infers higher bandwidth with respect to “low capacity channels.” However, high capacity channel can also refer to one or more of

1 higher capacity, less cost, increased reliability, and less latency with respect to low
2 capacity channel.

3 The present invention extends to both systems and methods for routing
4 notifications to wireless devices. The embodiments of the present invention may comprise
5 a special purpose or general purpose computer including various computer hardware, as
6 discussed in greater detail below. Embodiments within the scope of the present invention
7 also include computer-readable media for carrying or having computer-executable
8 instructions or data structures stored thereon. Such computer-readable media can be any
9 available media which can be accessed by a general purpose or special purpose computer.
10 By way of example, and not limitation, such computer-readable media can comprise RAM,
11 ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other
12 magnetic storage devices, or any other medium which can be used to carry or store desired
13 program code means in the form of computer-executable instructions or data structures and
14 which can be accessed by a general purpose or special purpose computer. When
15 information is transferred or provided over a network or another communications
16 connection (either hardwired, wireless, or a combination of hardwired or wireless) to a
17 computer, the computer properly views the connection as a computer-readable medium.
18 Thus, any such connection is properly termed a computer-readable medium.
19 Combinations of the above should also be included within the scope of computer-readable
20 media. Computer-executable instructions comprise, for example, instructions and data
21 which cause a general purpose computer, special purpose computer, or special purpose
22 processing device to perform a certain function or group of functions.

23 Figure 1 and the following discussion are intended to provide a brief, general
24 description of a suitable computing environment in which the invention may be

1 implemented. Although not required, the invention will be described in the general context
2 of computer-executable instructions, such as program modules, being executed by
3 computers in network environments. Generally, program modules include routines,
4 programs, objects, components, data structures, etc. that perform particular tasks or
5 implement particular abstract data types. Computer-executable instructions, associated
6 data structures, and program modules represent examples of the program code means for
7 executing steps of the methods disclosed herein. The particular sequence of such
8 executable instructions or associated data structures represent examples of corresponding
9 acts for implementing the functions described in such steps.

10 Those skilled in the art will appreciate that the invention may be practiced in
11 network computing environments with many types of computer system configurations,
12 including personal computers, hand-held devices, multi-processor systems,
13 microprocessor-based or programmable consumer electronics, cellular telephones, pagers,
14 personal digital assistants, network or desktop PCs, minicomputers, mainframe computers,
15 and the like. The invention may also be practiced in distributed computing environments
16 where tasks are performed by local and remote processing devices that are linked (either by
17 hardwired links, wireless links, or by a combination of hardwired or wireless links)
18 through a communications network. In a distributed computing environment, program
19 modules may be located in both local and remote memory storage devices. Those skilled
20 in the art will also appreciate that some computer system configurations, such as cellular
21 telephones, pagers, and the like are not required to have each component illustrated in
22 Figure 1 in order to qualify as a computer environment in which the present invention may
23 be implemented. For this reason, many devices, including but not limited to, cellular
24 telephones, PDAs, pagers and the like, qualify as a computer as described herein. In

1 addition, a computer as described herein is not limited to the components illustrated in
2 Figure 1.

3 With reference to Figure 1, an exemplary system for implementing the invention
4 includes a general purpose computing device in the form of a conventional computer 20,
5 including a processing unit 21, a system memory 22, and a system bus 23 that couples
6 various system components including the system memory 22 to the processing unit 21.
7 The system bus 23 may be any of several types of bus structures including a memory bus
8 or memory controller, a peripheral bus, and a local bus using any of a variety of bus
9 architectures. The system memory includes read only memory (ROM) 24 and random
10 access memory (RAM) 25. A basic input/output system (BIOS) 26, containing the basic
11 routines that help transfer information between elements within the computer 20, such as
12 during start-up, may be stored in ROM 24.

13 The computer 20 may also include a magnetic hard disk drive 27 for reading from
14 and writing to a magnetic hard disk 39, a magnetic disk drive 28 for reading from or
15 writing to a removable magnetic disk 29, and an optical disk drive 30 for reading from or
16 writing to removable optical disk 31 such as a CD-ROM or other optical media. The
17 magnetic hard disk drive 27, magnetic disk drive 28, and optical disk drive 30 are
18 connected to the system bus 23 by a hard disk drive interface 32, a magnetic disk drive-
19 interface 33, and an optical drive interface 34, respectively. The drives and their
20 associated computer-readable media provide nonvolatile storage of computer-executable
21 instructions, data structures, program modules and other data for the computer 20.
22 Although the exemplary environment described herein employs a magnetic hard disk 39, a
23 removable magnetic disk 29 and a removable optical disk 31, other types of computer
24

1 readable media for storing data can be used, including magnetic cassettes, flash memory
2 cards, digital versatile disks, Bernoulli cartridges, RAMs, ROMs, and the like.

3 Program code means comprising one or more program modules may be stored on
4 the hard disk 39, magnetic disk 29, optical disk 31, ROM 24 or RAM 25, including an
5 operating system 35, one or more application programs 36, other program modules 37, and
6 program data 38. A user may enter commands and information into the computer 20
7 through keyboard 40, pointing device 42, or other input devices (not shown), such as a
8 microphone, joy stick, game pad, satellite dish, scanner, or the like. These and other input
9 devices are often connected to the processing unit 21 through a serial port interface 46
10 coupled to system bus 23. Alternatively, the input devices may be connected by other
11 interfaces, such as a parallel port, a game port or a universal serial bus (USB). A monitor
12 47 or another display device is also connected to system bus 23 via an interface, such as
13 video adapter 48. In addition to the monitor, personal computers typically include other
14 peripheral output devices (not shown), such as speakers and printers.

15 The computer 20 may operate in a networked environment using logical
16 connections to one or more remote computers, such as remote computers 49a and 49b.
17 Remote computers 49a and 49b may each be another personal computer, a server, a router,
18 a network PC, a peer device or other common network node, and typically include many or
19 all of the elements described above relative to the computer 20, although only memory
20 storage devices 50a and 50b and their associated application programs 36a and 36b have
21 been illustrated in Figure 1. The logical connections depicted in Figure 1 include a local
22 area network (LAN) 51 and a wide area network (WAN) 52 that are presented here by way
23 of example and not limitation. Such networking environments are commonplace in office-
24 wide or enterprise-wide computer networks, intranets and the Internet.



When used in a LAN networking environment, the computer 20 is connected to the local network 51 through a network interface or adapter 53. When used in a WAN networking environment, the computer 20 may include a modem 54, a wireless link, or other means for establishing communications over the wide area network 52, such as the Internet. The modem 54, which may be internal or external, is connected to the system bus 23 via the serial port interface 46. In a networked environment, program modules depicted relative to the computer 20, or portions thereof, may be stored in the remote memory storage device. It will be appreciated that the network connections shown are exemplary and other means of establishing communications over wide area network 52 may be used.

Figure 2 is a block diagram that generally illustrates an environment wherein the present invention may be implemented. Figure 2 illustrates a system 200 that includes a server 202 and a wireless device 210. Exemplary wireless devices include, but are not limited to, cellular telephones, pagers, personal digital assistants (PDAs), Web TVs, Internet appliances, and the like. The server 202 has a store 204 and the wireless device 210 has a store 212. The store 204 typically has significantly more storage capacity than the store 212 and the store 204 is often used by multiple wireless devices as well as other computers. The server 202 is often part of a local area network (LAN). However, Figure 2 is intended to represent an instance where the server 202 is accessed by a wireless device. It is understood that the server 202 can be part of many other computer networks or other system configurations.

Often, it is necessary for the server 202 to communicate with or send a notification to the wireless device 210. This can occur, for example, when a new electronic message arrives at the server 202, or more generally, when an object stored at the server 202 changes. Changes to objects include, but are not limited to, deleting an object, creating an

1 object, moving an object, modifying an object, and the like. When a change to an object
2 occurs, a notification is generated at the server 202 and transmitted to the wireless device
3 212. As previously stated, the notification can simply advise the wireless device 210 of the
4 change to the object or the notification can actually contain the changed object. In the case
5 of email, for example, the notification can inform the wireless device 210 that a new mail
6 message is stored at the server 202 or the notification can include the new mail message.
7 In the first instance, a user of the wireless device 210 is required to retrieve the new mail
8 message. It is understood by one of skill in the art that the notification sent to the wireless
9 device 210 is not limited to email, but can include any data, including but not limited to,
10 calendar data, documents, and the like.

11 In order to keep the device continuously up to date, notifications are sent to the
12 wireless device 210 over a channel that is always available. A wireless Short Messaging
13 Service (SMS) or like technology channel is typically used because it can usually deliver a
14 notification message even though it has a lower transmission capacity. SMS describes the
15 ability to send and receive small text messages (on the order of 160 characters) to the
16 wireless device 210. SMS, or more generally, the low capacity channel 220, is not
17 conducive to sending or receiving long messages. In addition to being restricted to short
18 messages, SMS and similar wireless protocols can incur additional cost to the user,
19 especially if it is used to send large messages.

20 Figure 2 also illustrates a high capacity channel 230 that provides for
21 communication between the server 202 and the wireless device 210. While the high
22 capacity channel 230 overcomes the limitations of the low capacity channel 220, the high
23 capacity channel 230 is not always available for use in the system 200. However,
24 notifications are sent over the high capacity channel 230 instead of the low capacity

channel 220 whenever the high capacity channel 230 is available to the wireless device 210. This enables more data to be sent more quickly and more efficiently with less cost. Full synchronization between the wireless device 210 and the server 202 can also occur more efficiently over the high capacity channel 230. In addition, the cost of using the high capacity channel 230 is often significantly lower than the cost associated with the low capacity channel 220.

Figure 3 is a block diagram that more fully illustrates a wireless device that communicates with a server over a high capacity channel 230 or a low capacity channel 220. The low capacity channel 220 often includes a proxy 222 as an intermediary between the wireless device 210 and the server 202. The communication link 206 can be the Internet, a Local Area Network (LAN), and the like, but can also include wireless networks.

The proxy 222 communicates with the wireless device 210 over a wireless communication link 214 that is often provided by a wireless carrier. The communication link 214 often employs Short Messaging Service (SMS) or related technologies, which generally describe the ability to send small text messages over a wireless communication link. Because of the nature of wireless communications, there is no guarantee that message sent using SMS will actually arrive at the wireless device 210, but the nature of SMS coverage and buffering usually ensures the small SMS message will be delivered to the device in a timely manner. While SMS is useful in some circumstances, it is significantly less useful when the update is substantially larger than messages typically sent with SMS. These types of updates, for example, occur when the wireless device 210 and the server 202 synchronize the stores 204 and 212. Larger updates can also occur when sending calendar data or electronic messages that are longer than the messages permitted by SMS.

1 The proxy 222 includes applications (apps) 224 that assist in the process of sending
2 a notification to the wireless device 210. The applications 224 include a format module
3 and a wireless channel module. The format module formats the notification for the
4 intended client device, which is the wireless device 210 in this case. The wireless channel
5 module processes the notification such that the notification is compatible with the
6 transmission channel, which may be, for example, SMS.

7 Figure 3 also illustrates a network device 232. The network device 232 is capable
8 of communicating with the proxy 222 over the Internet, a LAN, and the like. The network
9 device 232 becomes part of the high capacity channel 230 when the wireless device 210 is
10 capable of communication with the network device 232. For example, the wireless device
11 210 may be a personal digital assistant (PDA), a cellular telephone or other wireless device
12 that is capable of docking or otherwise connecting with a network device such as a desktop
13 computer. When the PDA is docked or otherwise connected with the desktop computer,
14 the PDA has access to the desktop computer over a communication link 216 through
15 communication port 234, which may be a serial port, a universal serial bus port, an infrared
16 port, Bluetooth Personal Area Wireless connection, and the like. The communication link
17 216 has higher bandwidth than the communication link 214 and is significantly faster and
18 less expensive.

19 When the wireless device 210 is docked with the network device 232, the wireless
20 device 210 notifies the proxy 222 that notifications or updates can be sent through the
21 network device 232 instead of over the communication link 214. This has the advantages
22 of lower cost and significantly higher bandwidth. The wireless device 210 notifies the
23 proxy 222 that it can use the new high capacity channel 230 and the proxy 222 is provided
24 with a return address where notifications and updates can now be sent. In this case, the

1 proxy 222 is provided with the address of the network device 232 or the pass module 236.
2 In the proxy 222, a network channel module, which is included in the applications 224,
3 formats the updates or the notifications for the higher capacity channel or communication
4 link, which may be an Ethernet connection, the Internet, and the like. A pass module 236
5 passes the notifications or updates received from the proxy 222 through the network device
6 232 to the wireless device 210 over the communication link 216.

7 When the wireless device 210 has access to high speed networks through the
8 network device 232, the proxy 222 and the server 202 are effectively notified of this fact
9 through the network device 232. At this point, the proxy 222 re-routes or directs the
10 notifications and updates over the high capacity channel 230. From the perspective of the
11 server 202, notifications and updates are still sent to the proxy 222. In this manner, the
12 notifications and updates are rerouted through the network device 232 instead of over the
13 wireless communication link 214.

14 Because the proxy 222 is re-routing or re-directing the notifications, the proxy 222
15 is usually responsible for detecting when the high capacity channel is no longer available
16 to the wireless device 210 with respect to notifications and updates. The connection
17 between the wireless device 210 and the network device 232 can terminate abruptly. For
18 example, a PDA or wireless phone can simply be removed from a docking cradle.
19 Detecting when the link is severed can be accomplished in several ways. The wireless
20 device 210, for instance, may be required to send an acknowledgement to the proxy 222
21 for each notification that is received over the high capacity channel 230. If no
22 acknowledgement is received, the proxy 222 can assume that the connection has been
23 severed and the proxy 222 will resume sending notifications using the low capacity
24 channel 220. In some instances, the acknowledgement should be received within a

1 particular time period. If TCP/IP is used, then the severance of the communication link
2 will be detected when the socket is dropped or lost. Alternatively, the wireless device 210
3 can detect when the connection is lost and notify the proxy 222 over the low capacity
4 channel 220 that further notifications should be sent over the low capacity channel 220.

5 While the present invention has been described with the proxy 222 being an
6 integral part of both the low capacity channel 220 and the high capacity channel 230, it is
7 understood that the proxy 222 could be bypassed in some circumstances when the high
8 capacity channel 230 is available. As described, however, the server 202 is often unaware
9 of which channel is used to transmit the notifications and updates to the wireless device
10 210. In another embodiment, the network device may have direct access to the server 202
11 and will, as a result, perform the systems and methods described herein directly with the
12 server 202 instead of through the proxy 222.

13 The present invention may be embodied in other specific forms without departing
14 from its spirit or essential characteristics. The described embodiments are to be considered
15 in all respects only as illustrative and not restrictive. The scope of the invention is,
16 therefore, indicated by the appended claims rather than by the foregoing description. All
17 changes which come within the meaning and range of equivalency of the claims are to be
18 embraced within their scope.

19 What is claimed and desired to be secured by United States Letters Patent is:

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